Chapter 7
Remedial Design and Remedial Action

7-1. Introduction

a. Hazardous waste. A variety of options have been identified for remedial response and remedial actions at hazardous waste sites (EPA 1982, EPA 1988b). EPA guidance provides a framework or methodology for evaluating the feasibility and desirability of available methods. The regulations and guidance give strong preference for remedies that are highly reliable and provide long-term protection (EPA 1988b). In addition to the requirement for remedies to be protective of human health and the environment and to be cost-effective, other considerations for guiding the selection of remedial actions include the following:

(1) A preference for remedial actions that employ treatment that permanently and significantly reduces the volume, toxicity, or mobility of hazardous substances, pollutants, and contaminants as a principal element.

(2) Offsite transport and disposal without treatment is the least-favored alternative where practicable treatment technologies are available.

(3) The need to assess the use of permanent solutions and alternative treatment technologies or resource recovery technologies and use them to the maximum extent practicable.

Selection of remedial actions must also be based on site-specific conditions including the chemical and physical nature and extent of contamination, geological and geotechnical characteristics, and sociopolitical considerations. Broad categories of available remedial actions at hazardous waste sites include surface or subsurface treatment of air, water, soil, and other materials, and the treatment, storage, and disposal of the materials resulting from site remediation.

b. LLRW.

(1) Disposal. Disposal of LLRW or MW is the most common method of remediation. Design considerations for disposal of LLRW and MW must address:

(a) The method of removal of the LLRW.

(b) Assaying the LLRW or MW to determine disposal characteristics for the disposal site selected.

(c) Packaging in accordance with NRC and DOT regulations.

(d) Transport in accordance with NRC and DOT regulations.

(e) Coordination with state and compact officials for export, transportation through, and import of LLRW or MW.

(f) Disposal at a licensed disposal facility.

(2) Treatment. Treatment methods to reduce the radioactivity of a given radionuclide are impossible; the volume of a given radioactive waste form can be reduced by separation of radioactive components; or the concentration of radioactivity may be decreased by dilution. LLRW treatment methods are based on those two concepts and are commonly used to decontaminate tools, equipment, or components, to reduce volumes of radioactive materials, to improve waste forms, and to improve stability of the wastes. The resulting wastes are more amenable to safe handling and disposal, and the decontaminated tools, equipment, or components can be returned to service.

c. MW.

(1) Regulatory responsibility. Neither the regulations and guidance developed by EPA for hazardous or toxic wastes nor that developed by NRC for LLRW address the class of wastes defined as M W. EPA and NRC share responsibility for management storage and disposal of MW. EPA has jurisdiction over the hazardous waste components, while NRC regulates LLRW. As discussed previously, states may regulate hazardous waste and LLRW generated or disposed of within their borders through exercise of rights and responsibilities granted to them under RCRA authorization and agreement state status, respectively. States can also seek MW authorization, to regulate storage and disposal of MW within their borders.

(2) Regulatory guidance. To date, EPA and NRC have developed three joint guidance documents to assist waste generators, state regulatory agencies, and other involved parties (e.g., DOE) with identification and definition, conceptual designs, and siting guidelines for MW disposal facilities. These guidance documents are described in appendixes to this EM. Joint guidance for remediation of sites with contamination by MW has not been specifically developed to date. However, MW generators and parties responsible for remediation of

MW-contaminated sites must comply with the appropriate EPA regulations dealing with the hazardous waste constituents and NRC or equivalent state regulations dealing with the LLRW constituents. If conflicts arise in satisfying the dual regulations, exemptions can be sought from RCRA requirements on a case-by-case basis, as discussed in section 1006 of RCRA. The general procedure for filing a petition for variance is discussed in the joint EPA/NRC guidance document (NRC-EPA 1987a, b, and c).

(3) Remedial options. In the following paragraphs, the remedial options available for LLRW and hazardous wastes are summarized. 40 CFR 268, "Land Disposal Restrictions, " bears directly on the choice of alternatives for the treatment or disposal of MW. 40 CFR 268.35 D and E require the hazardous component MW to be treated to meet LDR exposure requirements. Very few waste treatment facilities have the capability of handling the radioactive components while treating the hazardous components. Remediation efforts at sites contaminated by MW, or where MW wastes are stored, should be guided by integrating the separate regulations, guidance, and remedial options for LLRW and hazardous wastes. Trade-offs, compromises, and negotiations with the regulatory authorities may be necessary in many cases to achieve effective cleanups that protect the environment and public health and safety.

7-2. LLRW and MW Treatment

a. Treatment options. As mentioned in the introduction to this section, treatment options for LLRW are limited essentially to altering the form of the waste. In general, treatment methods may be used to decontaminate equipment, tools, components, or structures, to reduce volumes, to improve waste forms, or improve stability of wastes. Reduction of waste volume increases the radionuclide concentration. Separation of the waste into unmixed components may simplify waste management. In many cases the radioactive component of the residual waste remains a radioactive waste to be disposed of in a facility approved for radioactive waste. MW may contain hazardous components that are treatable to a nonhazardous status in such a way as to not disperse or otherwise accentuate the radioactive phase of the waste or generate new LLRW or MW. 10 CFR 61 allows such treatment with appropriate controls. This way the MW may, in some instances, be convertible to LLRW and disposed of as such.

b. Improvements. Improvements in waste form and stability are usually achieved by measures such as packaging wastes in durable containers, mixing wastes with cement slurries and placing them in durable containers or engineered structures, and compaction. Ion-exchange for removal of radioactively contaminated metal ions, such as is used to cleanse reactor cooling water supplies, is a technology employed to remove liquids, reduce volumes, and improve the waste form. Decontamination is the removal of radioactive material from where it is not wanted. Some decontamination methods can result in waste volume reduction, but others actually produce larger volumes of wastes that must be dealt with. Decontamination methods may be grouped into mechanical and chemical methods or into methods appropriate for removal of surface contamination and those useful for removal of deep contamination.